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COMBINING ABILITIES STUDIES IN ANTHURIUM

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ABSTRACT

A study was undertaken to estimate the general and specific combining ability in Anthurium lines through line x tester analysis involving six lines and three testers. The combining ability analysis revealed highly significant differences among the treatments for all the parameters studied. Among the parental lines IIHR selection A1 appeared to be best general combiner for all the component characters based on the estimates of GCA. The tester Eternity was found to be good general combiner for percent seed germination and leaf area. The most promising specific combinations based on the SCA effect was IIHR selection A1 X eternity for disease resistance and meringue white X tropical for economic characters. This indicated both additive and non additive paying a great role in the inheritance of the trait. This study could be exploited for in development of anthurium breeding programs.

KEYWORDS: Combining Abilities Studies in Anthurium, Line x Tester Analysis Involving Six Lines and Three Testers

INTRODUCTION

Mankind and ornamentals share a very old relation for their new colors, altered forms, enhanced fragrance and increased longevity. Anthurium is one such valued ornamental crop belonging to areacea family. Anthurium flowers are very small, arranged on a stalk-like structure called the spadix. Pollinators are mainly attracted by a large colourful bract, called the spathe (Promyoua *et al*, 2012).

In decades earlier, 90 % of the export industry consisted of anthurium showing its importance in the horticulture industry. The present anthurium varieties are running out of fashion because of which the market value has been decreased. Anthurium cultivation is hindered due to the inherent heterozygosity nature. There is a need to increase overall production to meet the demand. This can be achieved either by raising the productivity by increasing in area under cultivation. The increase in productivity can be achieved by adopting the high yielding F1 hybrids through breeding programs. The success of any hybrid breeding programme depends upon the choice of parents and clear knowledge of gene action for specific traits (Venkatesh *et al.,* 2001). Combining ability analysis helps the breeder in the task of selecting the parents. The basic information on the nature of gene action and their expression of the character is provided from this study. Hence it is necessary to evaluate the combining ability, which is useful to assess the nicking ability of parents, at the same time elucidates the nature and magnitude of different types of gene action involved. This can be of immense help to plant breeders. Line x tester analysis is a precise method for obtaining such information when a few number of parents are to be tested. Keeping the above things in view, the present study was designed to find out the good general combining genotypes

for best breeding program and to identify high yielding combiners for the development suitable new anthurium hybrid.

MATERIALS AND METHODS

The present study was carried out at Indian institute of Horticulture Research (IIHR) during the Rabi 2012 to 2013. The experimental material consisted of 18 F1 population developed by crossing six lines, viz. Hondurus Red, Singapore Red, Meringue White, Regina, Deep Pink, IIHR selection A1 with three testers, viz. Simba, Tropical, and Eternity. The F1 along with the parents were evaluated in randomized block design with four replications. The beds of 1m width and convenient length of 60 cm between the beds under 75% shade net were followed. The observation was recorded on five randomly selected plants for percent seed germination, plant height, number of leaves, leaf area, number of primary roots, number of secondary roots, root length, percent disease incidence after 6 days and percent disease incidence after 12 days. Analysis of variance of the data was done using model suggested by Panse and Sukhatme (1984). General and specific combining ability effects were estimated by adopting the procedure detailed by Griffing (1956).

RESULTS AND DISCUSSIONS

The analysis of variance revealed significant difference among parents (line and tester), crosses and parent vs crosses except for plant height and percent disease incidence on 6 days for hybrid vs crosses (Table 1). The results revealed that mean square due to general combining ability (GCA) and specific combining ability (SCA) were highly significant. This indicated that both non-additive and additive type of gene effects imparting a vital role in the inheritance of all the traits similar to a study in bread wheat (Dholariya *et al*, 2014).

The estimation of the GCA effect (Table 2) revealed that the parent IIHR selection A1 was best combiner for all the characters viz. percent seed germination, plant height, number of leaves, leaf area, number of primary roots, number of secondary roots, root length, percent disease incidence after 6 days and 12days. Aswath and Devender (2005) reported that IIHR selection A1 is found to tolerant to Bacterial blight. Similar observation were reported by Elibox and Umaharan (2007) were the cultivars resistant to bacterial blight were found be best combiners. For plant height, number of leaves, leaf area, root length, percent disease incidence for 6 days and 12 days meringue white was found to be a good combiner. Among the testers, Eternity was good combiner for percent seed germination and leaf area. Tropical was a good combiner with respect to plant height. None of the other testers were found to be good combiners for the other characters. Therefore, these parents with high GCA effect could be extensively used in hybridization programme for the improvement of the traits.

The SCA effect of the 18 crosses has been presented in Table 3. The cross eternity X IIHR selection A1 was found to be best specific combiner in the desirable characters viz. percent seed germination, plant height, leaf area, number of primary roots, secondary roots, root length, percent disease incidence for 6 days and 12 days. This cross has been used to develop F1 population for construction of linkage map in anthurium (Venkat *et al*, 2014). The cross meringue white X tropical exhibited second highest specific combining for percent seed germination, number of leaves, leaf area, number of secondary roots and root length. The hybrids simba X singapore red exhibited significant SCA effect for secondary roots, root length, percent disease incidence for 6 days and 12 days. Among the crosses simba X IIHR selection A1 and tropical X IIHR selection A1 found to be good specific combiners for percent disease incidence.

GCA effects can be considered as the numerical values assigned to the parents in relation to their mean performance in cross combinations. It was observed from the present studies that IIHR selection A1 is a good combiner for

all the characters and this cultivar exhibited good combining abilities for all character except for leaf area indicating that it can be used as parent for high evolving high yielding and resistant genotypes. The second best combiner was meringue white for plant height, number of leaves, leaf area, root length, percent disease incidence for 6 days and 12 days. The specific crosses of meringue white X tropical showed good combining abilities for percent seed germination, number of leaves, leaf area, number of secondary roots and root length which could be used to study the heterosis in anthurium.

CONCLUSIONS

Despite great progress and interest in modern molecular breeding tools ornamental breeding is lagging due to lack of knowledge of the genetic resources. In Anthurium breeding, one of the most critical step belongs to selection of parents with good combining ability with resistance to bacterial blight. The variances for general combining ability and specific combining ability were significant and highly significant for all studied traits which indicate the presence of additive as well as non-additive gene effects. Till to date no such studies has been carried out in anthurium this study could prove be stepping stone for anthurium breeding programs.

REFERENCES

1. Aswath, C., & Devender, Prakash., (2005). Breeding for scented Anthurium. Short com-munication. J. Ornamental Hortic. 8, 237–238.
2. Dholariya, N. D., Akabari, V. R., Patel, J. V., Chovatia, V. P., (2014). Combing ability and gene action for grain yield and its attributing traits in bread wheat. Electron J Plant Breed. 5(3), 402-407.
3. Elibox W., & Umaharan P., (2010). Cultivar differences in the deterioration of vase-life in cut-flowers of *Anthurium andraeanum* is determined by mechanisms that regulate water uptake. Sci. Hortic. 124, 102–108.
4. Griffing, B., (1956). Concept of general and specific combining ability in relation to diallel crossing systems. Aust. J. Biol. Sci. 9, 463-493.
5. Panse, V. G., & Sukhatme, P. V., (1978). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research. New Delhi.
6. Promyoua, S., (2012). Salicylic acid alleviates chilling injury in anthurium (Anthurium andraeanum L.) flowers. Sci. Hortic. 64, 104–110.
7. Venkat, S. K., Bommishetty , P., Patil, S. M., Reddy, L., Aswath, C., (2014). The genetic linkage maps of Anthurium species based on RAPD, ISSR and SRAP markers. Sci. Hortic 178, 132–137.
8. Venkatesh, S., Singh, N. N. and Gupta, N. P., (2001). Early generation identification and utilization of potential inbred lines in modified single cross hybrids of maize (*Zea mays* L.). Indian J. Genet., 61(3), 213-217.

APPENDICES

Table 1: Analysis of Variance and Variance Estimates of Combining Ability for Different Characters in Anthurium

Source of Variation	Df	Percent of Seed Germination	Plant Height	No of Leaves	Leaf Area	No of Primary Roots	No of Secondary Roots	Root Length	Disease 6 Day	Disease 12 Day
replication	3	20.15	10.19	120.08	1025.65	13.74	327.39	21.9	0.281	0.324
treatments	27	1.31*	1.39*	28.32*	148.21*	4.49*	35.06*	1.33*	0.014*	0.025*
parents	8	1.56*	1.39*	28.44*	245.66*	6.70*	100.60*	0.67*	0.017*	0.051*
crosses	17	1.29*	1.31*	20.55*	55.52*	3.66*	11.52*	1.69*	0.013*	0.026*
hybrid vs cross	1	0.83*	2.95*	0.23	2377.91*	42.96*	67.97*	5.08*	0.01	0.016
error	55	0.09	0.04	0.72	5.3	0.05	14.75	0.07	0.001	0.007

* Significant at 5 % probability

Table 2: Estimates of GCA Effects of Lines and Testers for Different Characters

Sl. No	Parents	Per Cent Seed Germination	Plant Height (Cm)	Number of Leaves	Leaf Area (Mm^2)	Number of Primary Roots	Number of Secondary Roots	Root Length (Cm)	Per Cent Disease Incidence After 6 Days	Per Cent Disease Incidence After 12 Days
	Testers (Male) Simba (S) Tropical (T) Eternity (E)									
1	**Lines**	-7.28*	-0.06	0.24*	-1.92*	-0.76*	0.60*	-0.06*	-0.24*	-0.34*
2	**(Female)**	-2.01	0.28*	0.07*	-1.22*	-0.28	0.35*	-0.02	0.29*	0.49*
3	Hondurus Red (HR)	9.29*	-0.22	-0.31	1.14*	-0.49	-0.94	0.08*	-0.05	-0.08
4	Singapore	2.11*	-0.06	-0.10	-1.35	0.39*	-0.27	0.02*	-0.46	-0.66
5	Red (SR)	3.47*	-0.14	-0.10	0.04*	-0.03	0.22*	0.01*	0.46*	0.56*
6	Meringue	-1.24	0.12*	0.82*	1.67*	-0.61*	-0.36	0.22*	0.53*	0.73*
7	White	-1.80	-0.04	0.09*	-1.48	-0.06	-0.53*	-0.29	-0.04	-0.09
8	(MW)	-15.25*	-0.74	-1.18	-0.19	-1.03	-0.44	-0.78	0.64*	0.74*
9	Regina (R) Deep Pink (DP) IIHR selection A1 (AO)	7.37*	0.80*	0.65*	3.21*	1.12*	1.39*	0.83*	1.13*	3.13*
	S.E (g_i)	1.37	0.08	0.13	0.39	0.13	0.15	0.09	0.09	0.11
	C.D at 5 %	4.11	0.24	0.40	1.17	0.39	0.45	0.28	0.27	0.34

* Significant at 5 % probability

Table 3: Estimates of Specific Combining Ability Effects for the 18 Hybrids with Regard to Nine Characters in Anthurium

Sl. No	Parents	Per Cent Seed Germination	Plant Height (Cm)	Number of Leaves	Leaf Area (Mm^2)	Number of Primary Roots	Number of Secondary Roots	Root Length (Cm)	Per Cent Disease Incidence After 6 Days	Per Cent Disease Incidence After 12 Days
1	S X HR	8.24*	-0.27	-0.24	-0.81	-0.09	-0.26	0.23*	-0.17	-0.27
2	S X SR	-0.70	-0.04	-0.01	-3.63	-0.69*	1.24*	0.70*	0.43*	0.49*
3	S X MW	3.91	0.19*	0.35*	0.32*	-0.35*	-0.43	0.38*	-0.07	-0.17
4	S X R	-2.70	0.56*	-0.24	-0.36	0.74*	0.49*	-0.22	0.51*	0.61*
5	S X DP	-12.17*	-0.15	0.10*	-0.63	-0.18	-0.60	-0.13	-0.37	-0.47
6	S X AO	3.43*	-0.29	0.01*	2.13*	-0.18	-0.43	-0.96	0.79*	0.89*
7	T X HR	-5.15*	-0.03	-0.32	0.20	0.19*	-0.51	-0.37	-0.43	-0.53
8	T X SR	3.22*	0.12*	0.18*	0.33	0.11*	-0.51	-0.48	0.19*	0.29*
9	T X MW	2.98*	0.18*	0.26*	3.03*	-0.06	0.32*	0.23*	-0.09	-0.19
10	T X R	-1.89	-0.31	-0.07	-0.33	0.22*	-0.01	0.37*	-0.02	-0.12

11	T X DP	-1.70*	0.21*	-0.01*	-1.78	0.11*	0.65*	-0.02	0.07*	0.17*
12	T X AO	2.54*	-0.15	-0.07	2.11*	-0.01	0.77*	0.26*	0.29*	0.39*
13	E X HR	-3.09*	0.30*	0.56*	-3.01	-0.18	-0.72	0.14*	-0.61	-0.71
14	E X SR	-2.52	-0.07	-0.19	3.30*	0.40*	0.11*	-0.22	-0.62	-0.72
15	E X MW	-6.89*	-0.36*	-0.61	-2.71*	-0.16	-0.81	-0.34	0.16*	0.26*
16	E X R	4.59*	-0.24	0.31*	-0.02	-0.51	-0.47	-0.61	-0.96	-0.98
17	E X DP	13.89*	-0.06	-0.11	2.02*	0.07*	-0.06	-0.16	0.31*	0.51*
18	E X AO	5.97*	0.44*	0.06*	2.42*	0.32*	0.36*	0.69*	0.98*	1.01*
	S.E (g_i)	3.37	0.02	0.31	0.95	0.31	0.39	0.23	0.23	0.23
	C.D at 5 %	10.12	0.07	0.94	2.85	0.94	1.17	0.70	0.70	0.70

* Significant at 5 % probability